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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/879,556

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Jong-Hyon Ahn

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03/19/2003

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EXAMINER

HU, SHOUXIANG

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 03/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application N .

09/879,556

Applicant(s)

AHN, JONG-HYON 

Examiner

Shouxiang Hu

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 December 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-42 is/are pending in the application.
- 4a) Of the above claim(s) 5-7 and 10-42 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) 1-4, 8 and 9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 June 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 10.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Priority***

1. This application claims the priority under 35 U.S.C. 119 based on priority application serial No. 00-64557, filed on 11/01/2000 in Republic of Korea.

### ***Pending Claims***

2. Claims 1-42 are pending in this application; and claims 1-4, 8 and 9 remain active in this Office action, in view of the previous Office action.

### ***Claim Objections***

3. Claims 1-4, 8 and 9 are objected to because of the following informalities/defects:

In claims 1 and 2, the term of "elongate trench" should read just as --trench--, since the word trench inherently means a long and narrow structure. Otherwise, the term of "elongated trench" may cause some confusion regarding whether the trench's high is elongated with respect to the width, or vise versa.

In claims 1-4, 8 and 9 the term of "metal interconnection layer" should read as: --interconnection structure--, as the "metal interconnection layer" is formed inside the trench, instead of comprising the trench, in view of the instant specification.

In claim 4, the term of "surrounding" should read as: --abutting--, because, unlike a contact hole, the trench may not be necessarily fully surrounded by the ILD, in view of the original disclosure.

Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

5. Claims 1-3, 8 and 9, as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 102(e) as being anticipated by Chopra ("Chopra"; 6,413,858).

Chopra discloses an interconnection structure for a semiconductor device (Fig. 7; also see col. 6, lines 1-28, and col. 8, lines 54-60), comprising: a trench (14) formed in an ILD film (12; BPSG); and a conductive layer (a portion of 26 that is within the trench; Cu) formed in the trench and having an upper portion with a first width and a lower

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portion with a second width, wherein the second width is wider than the first width. In addition, it is noted that the conductive layer formed in the trench inherently forms a conductive line in the trench, since a trench inherently has a long and narrow structure.

Regarding claims 2, 3, 8 and 9, the interconnection structure in Chopra further comprises a barrier layer (20, 22, and/or 24) deposited along the bottom and side surfaces of the trench.

Furthermore, regarding claim 8, Chopra further discloses that the barrier layer can be formed with Ta (see col. 4, lines 39-43).

### ***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chopra ("Chopra"; 6,413,858) in view of JP'407 (JP 11-317407, 11/16/1999; of record) and/or Liaw et al. ("Liaw"; 5,554,565).

The disclosure of Chopra is discussed as applied to claims 1-3, 8 and 9 above.

Chopra does not disclose that the trench itself is bottle-shaped and has a wider width at its lower portion. However, one of ordinary skill in the art would readily recognize that it is desirable to have a bottle-shaped opening structure for preventing the filling material in the opening structure from being adversely easily pulled out, as

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evidenced in JP'407 (see Fig. 1d; also see the English abstract); and that such a bottle-shaped opening structure can be readily formed in the BPSG ILD, as evidenced in Liaw (see Fig. 1F), wherein a bottom-shaped trench is formed through a simple process, and the thickness of the ILD in its upper portion abutting the narrower-width portion of the trench is within the range of 20-70% of the thickness of the entire ILD film (20).

Therefore, it would have been obvious to one of ordinary skilled in the art at the time the invention was made to make the interconnect structure of Chopra with the trench being bottle-shaped and with the thickness of the ILD in its upper portion abutting the narrower-width portion of the trench being within the range of 20-70% of the thickness of the entire ILD film, per the teachings of JP'407 and/or Liaw, so that an interconnect structure with the conductive line being hard to be pulled out would be obtained through a simple process.

### ***Response to Arguments***

8. Applicant's arguments with respect to claims 1-4, 8 and 9 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is (703) 306-5729. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



SH  
March 12, 2003

